Remarks / Arguments

I. Support for Amendments

Amendments to the Specification and Claims are supported throughout the application as filed. Exemplary support is provided for each amendment for the convenience of the Examiner.

The specification is amended to include subtitles for "Technical Field", "Background Art", Brief Summary of the Invention" and "Detailed Description of the Invention". These amendments are to clarify the passages which follow for the reader's convenience.

The specification is also amended to provide a new paragraph as the summary of the invention. The new paragraph corresponds to independent claims 1 and 10 prior to amendment. Amendments that conform the disclosure to the recited claims are not considered prohibitory new matter. *Ex parte Porter*, 25 USPQ 2d, 1144, 1146 (B.P.A.I. 1992). Further support may be found at pages 8-9, which provide,

> In the context of the invention, active or direct wetting is to be understood as meaning that the desired treatment of one side of the substrate is ensured directly by the substrate being passed through the treatment liquid...
>
> By contrast, in the context of the invention passive or indirect wetting is to be understood as meaning that the underside of the substrate which is to be treated is above the level of the liquid throughout the entire duration of the treatment, and consequently wetting is effected only indirectly by means of components of the system which for their part are in contact with the liquid and are responsible for welling the substrate undersides.

Claims 1, 10 and 27 are amended to further clarify the top side of each wafer is not treated. Support may be found at page 4, lines 30-36, which provide,

> Therefore, the object of the present invention is to provide a process for treating one side of silicon wafers in which it is possible to make do without the process steps of the prior art involving protecting or masking the front surfaces or top sides which are not to be treated, yet the process can preferably be carried out in a production line.

Claims 1 and 27 are amended to newly add that a meniscus is positioned at edges of the wafer. Support may be found at page 10 lines 14-32, which provide in part,

> According to one embodiment of the present invention, the substrates are laid on a conveyor system, such as for example a roller conveyor system. In this case, the substrates are conveyed with the aid of a plurality of conveyor rolls (1) arranged one behind the other and oriented horizontally…In this case, a meniscus may form at the substrate edges. The interplay of gravity and surface tension then draws the substrate downward and ensures that it remains in contact with the rolls without floating. This allows controlled and defined conveying of the substrates using the roll conveyor system.

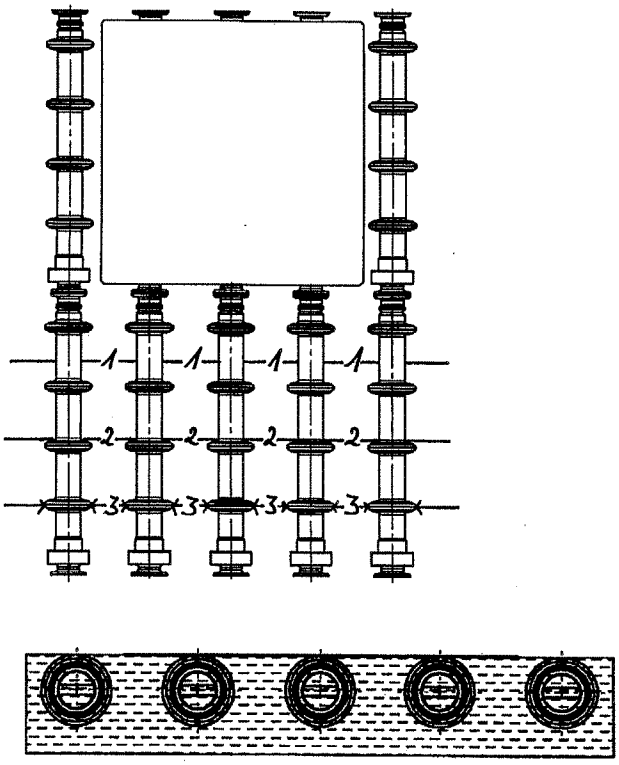
Claim 10 is amended to newly add that a meniscus forms between the underside and a surface of the liquid in the liquid bath. The limitation further confirms a portion of the bath underneath the silicon wafer is elevated with respect to the surrounding surface for contact the with underside of the wafer. Further support may be found as demonstrated above with respect to claim 1.

II. Introduction to the Invention

With respect to claim 1, a process for wet-chemical treatment of one side of a silicon wafer using a liquid bath is provided. During the treatment the silicon wafer lays on conveyor means and the entire surface of the underside to be treated is conveyed through or over liquid located in the liquid bath. The conveyor means are positioned within the

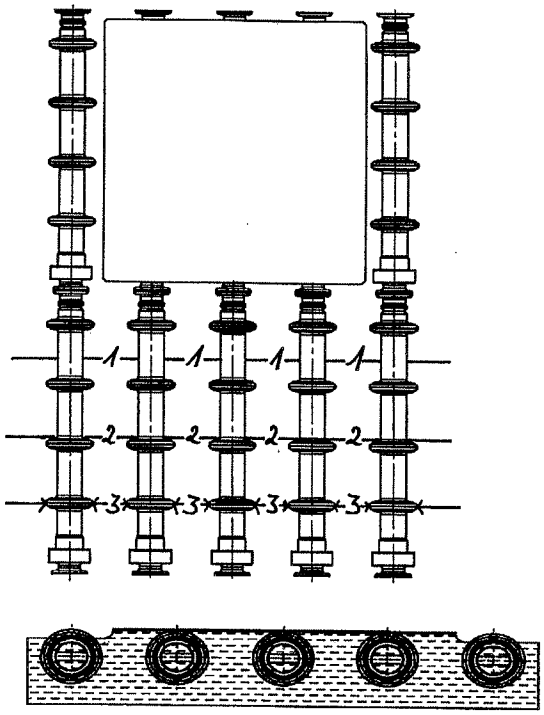
liquid bath. The top side, which is not to be treated, is always positioned above the liquid. An example of this configuration is depicted as Exhibit A.

EXHIBIT A



With respect to claim 10, a process for wet-chemical treatment of one side of a silicon wafer using a liquid bath is provided. During the treatment the silicon wafer lays on conveyor means and is conveyed with the underside to be treated through or over liquid located in the liquid bath. The level of the liquid being contacted by the underside is maintained above the level of the bath surface not being contacted by the underside. As a result a meniscus forms between the underside and the liquid within the liquid bath. The top side, which is not to be treated, is always positioned above the level of the liquid. An example of this configuration is depicted as Exhibit B.

EXHIBIT B



III. Examiner's Interview

Applicant thanks Examiners Norton and Angadi for the telephonic interview conducted on January 6, 2011 with Attorney of Record, Raymond Wagenknecht (Reg. No. 50948). During the interview independent claims 1 and 10 were discussed in comparison to the Hiraishi et al. reference. Exhibits A and B shown above were provided.

While the interview did not result in the allowance of any particular claim it was thought that an obviousness rejection of claims 1 and 10 would require a reference beyond Hiraishi et al. since Hiraishi et al. totally immerse the module to treat grooves scribed on the top side. Proposed amendments directed towards a meniscus in the independent claims were thought to further distinguish the invention from Hiraishi et al; however, the Examiners indicated such an amendment would require an additional search.

IV. Response to Objections to the Specification

The Examiner objects to the specification as lacking subtitles. Subtitles for Technical field, Backround Art, Brief Summary of the Invention and Detailed Description of the Invention are added. Accordingly, Applicant respectfully requests this objection be withdrawn.

V. Response to Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1-27 are rejected under 35 U.S.C. § 103(a) as being obvious over Hirashi et al. (US 6,506,260). In the rejection the Examiner argues that Hiraishi et al. disclose treatment of one side of a silicon wafer in a liquid bath without requiring the top side to be protected or masked.

A. Standard for Obviousness

A proper obviousness rejection requires consideration of the factual inquiries provided in Graham v. John Deere Co., 38 U.S. 1, 148 USPQ 459 (1966), including: 1) determining the scope and contents of the prior art; 2) ascertaining the differences between the prior art and the claims at issue; 3) resolving the level of ordinary skill in the pertinent art; and 4) considering the objective evidence present in the application indicating obviousness or nonobviousness. Although Graham v John Deere requires that certain factual inquiries be conducted to support a determination of the issue of obviousness, the actual determination requires an elevation in light of the findings in those inquiries as to the obviousness *of the claimed invention as a whole*, not merely the differences between the claimed invention and the prior art. Lear Siegler, Inc. v Aeroquip Corp., 221 USPQ 1025, 1033 (Fed. Cir. 1984). Further, a determination of patentability under 35 U.S.C. § 103(a) should be made upon the facts of the particular case in view of the totality of the circumstances. In re Dillon, 919 F.2d 688, 692-93 (Fed. Cir. 1990).

B. Claims 1-27 are not obvious because the technical approach taken by Hiraishi et al. is to treat the top side of the wafer by submerging the entire photovoltaic module; whereas claims 1-27 treat the underside of the silicon wafer while the top side, which is not to be treated, is always positioned above the liquid.

Independent claims 1, 10 and 27 are amended to recite that, with respect to the treated silicon wafer, the top side which is not to be treated is always positioned above the liquid. This is consistent with Applicant's object of the invention, which is to treat only one side of the silicon wafer, namely the underside.

In contrast, the object of Hiraishi et al. is to wash debris from laser scribed grooves, which are positioned on the top side of the photovoltaic module. Removal of debris is accomplished by immersing the entire photovoltaic module in a bath and sonicating its contents. Debris left over from the laser scribing process is depicted in FIG. 7B, annotated below.

Debris for washing

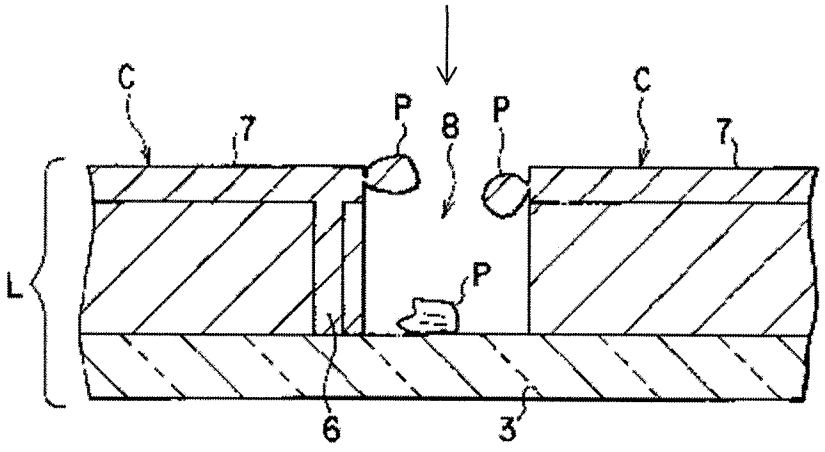


FIG. 7B

Hirashi's immersion of the entire photovoltaic module is depicted in FIG. 1, annotated below.

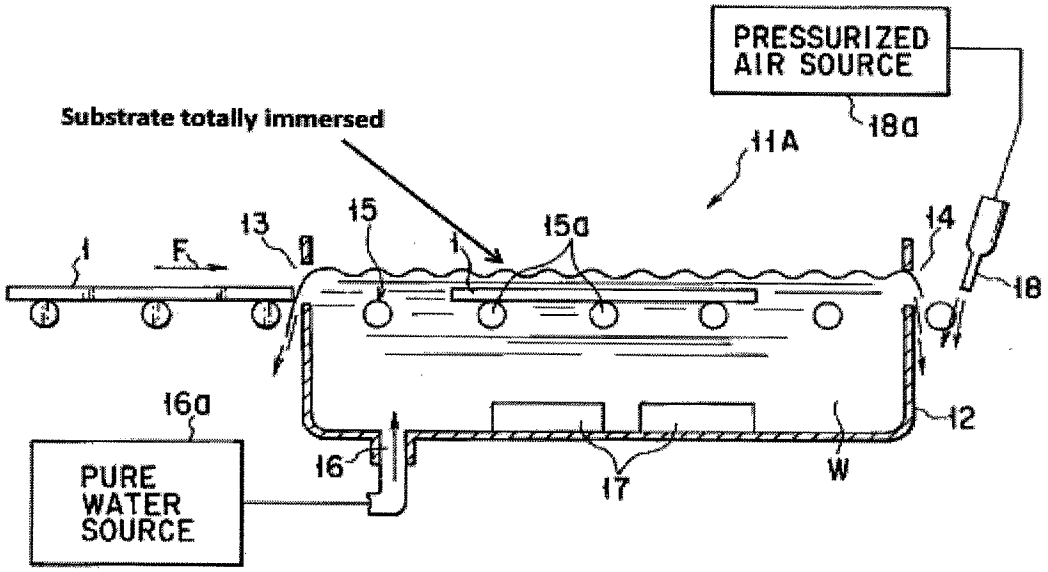


FIG. 1

For completeness, a total emersion approach or dipping approach was considered in the present application; however, treating the underside without treatment of the top side using this approach requires further protection of the top side from the bath. The requirement of a protective masking is a problem addressed by the invention at page 4,

> By way of example, DE 43 24 647 A1 and US 2001/0029978 A1 describe a multistage etching process in which a substrate is completely immersed in an acid bath. Since it is only the back surface and the edges of the substrate which are being etched here in each case, the front surface of the substrate has to be protected by an acid-resistant photoresist or a mask.
>
> In particular, the etching process described in DE 43 24 647 A1 and US 2001/0029978 A1 is not just time-consuming, since special working steps are required for the application and removal of protective layers, but also requires the use of additional materials. In particular, the application and removal of protective

layers entails the risk of the substrates which are to be treated being adversely affected. Should a protective layer applied be defective or damaged, there is a risk of the front surfaces of the substrates being damaged during etching, so that the substrates become unusable

Thus, in contrast to claims 1-27, Hiraishi et al. require the complete immersion of the substrate instead of the top side being maintained above the liquid. Further, Hiraishi et al. require treatment of the top side of the substrate instead of excluding treatment of the top side. Still further, adaptation of Hiraishi et al.'s method for selective treatment of an underside would require further protection or masking the top side, which is one of the specific problems solved by the present invention. These differences are such that claims 1-27 are not obvious over Hiraishi et al.

C. Treating the underside of a silicon wafer by conveying the wafer through or over a liquid bath extends beyond optimization of Hiraishi et al.'s methods and thus the claims are not obvious over Hiraishi et al.

In the Office Action at page 6, the Examiner proposes the skilled artisan could lower the level of the fluid in Hiraishi et al.'s bath, which would render the claims obvious.

As a preliminary matter, lowering the fluid below the top side would be inconsistent with Hiraishi et. al's approach since the scribed grooves and debris are positioned on the top side. In other words, lowering the fluid below the top side to avoid treatment of the top side would not permit removal of the debris from the grooves. Again, in Hiraishi et al. the object is to treat the grooves scribed along the top side. Thus, a skilled artisan would not look to a reference that treats a top side of a substrate when selective treatment of an underside without additional protecting steps, such as masking, is desired.

Second, the silicon layer in Hirishi et al. is a middle layer of a laminate. Thus, in contrast to the claims, the underside of the silicon layer is not treated in Hiraishi et al. Instead, the entire module, which includes a sandwiched silicon layer, is treated. Therefore, the

skilled artisan would not likely look to Hiraishi et al's treatment of a multilayer laminate to treat a wafer of silicon. Hiraishi et al's multilayer laminate can be seen in the FIG. 7A (annotated below) which depicts the various layers of Hiraishi et al.'s photovoltaic module:

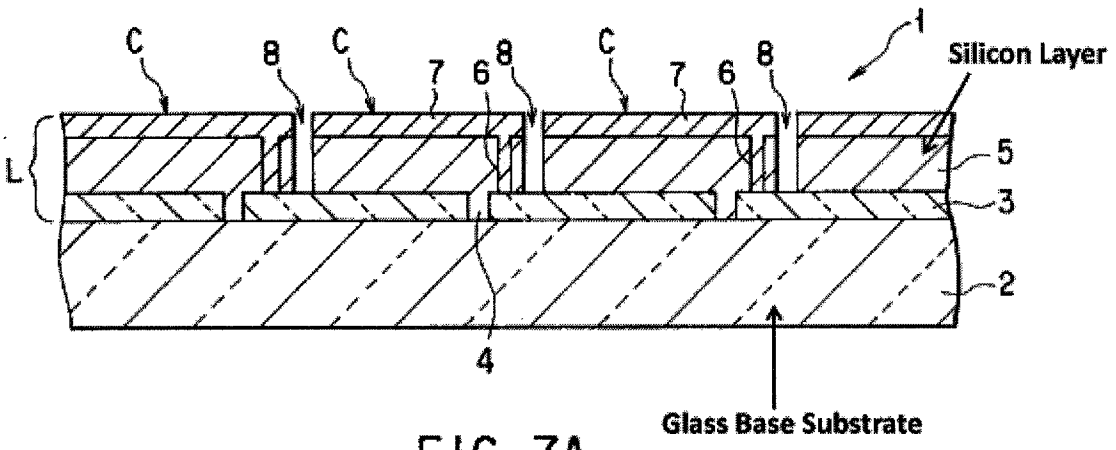


FIG. 7A

Third, differences between the photovoltaic module used in Hiraishi et al. and the silicon wafer as provided in the present application are such that one skilled in the present art would not apply the bath system provided Hiraishi et al. for the treatment of a silicon wafer and thus the invention would not be accomplished through the optimization of the fluid level in Hiraishi et al.

Consideration of the Hiraishi et al. approach must also take into account characteristics of the substrate, which is to be treated. For instance, as shown above, Hiraishi et al. do not treat a silicon wafer but instead treat a multilayer module that includes a middle silicon layer. As a result, another significant difference between Hiraishi et al.'s layered photovoltaic module and the present invention is that the photovoltaic module sinks, whereas the silicon wafer as set forth in the present invention tends to float. As such, the skilled artisan would not seek to convey a silicon wafer through or over a liquid bath by laying the wafer on a conveyor means because it would tend to float away and thus not convey properly. Viewing Hirashi et al.'s FIG. 1A it is evident that the multilayer

module sinks. Turning to the present invention it was surprisingly found that when using a silicon wafer a meniscus can form that assists in the conveying and selective wetting of the wafer. In other words, while silicon wafers tend to float it was surprisingly found that they could be conveyed due to interactions within the system. This is summarized at page 10, lines 26-32,

> In this case, a meniscus may form at the substrate edges. The interplay of gravity and surface tension then draws the substrate downward and ensures that it remains in contact with the rolls without floating. This allows controlled and defined conveying of the substrates using the roll conveyor system.

To further distinguish independent claims 1 and 27 from Hiraishi et al., Applicant has amended claim 1 to recite that a meniscus is positioned at edges of the wafer.

With respect to independent claim 10, the method includes the level of the liquid being contacted by the underside is maintained above the level of the bath surface not being contacted by the underside. That is, in claim 10 a portion of the liquid is raised to contact the underside of the wafer. This limitation refers to a meniscus extending between the underside of the wafer and the liquid bath. Clearly the skilled artisan would not consider such a feature to be a mere optimization of fluid level as set forth in Hiraishi et al. since the wafer is above the surrounding bath. Therefore to further expedite an allowance Applicant has amended claim 10 to recite that as a result a meniscus forms between the underside and a surface of the liquid in the liquid bath.

D. Conclusion

In view of the amendments and remarks set forth above Applicant respectfully requests reconsideration and withdrawal of the rejections. Applicant respectfully submits all claims are in condition for allowance.

Respectfully submitted,

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Date

Raymond Wagenknecht
Reg. No. 50948

Biotech Beach Law Group PC
5677 Oberlin Dr. Ste 204
San Diego, CA 92121
(858) 587-2510 x 201